

What is claimed is:

- 1        1.     A device comprising:
  - 2              a first particle separating channel and a second particle separating channel,
  - 3              said second particle separating channel transverse to said first particle separating channel
  - 4              and in communication therewith; and
  - 5              at least two spaced apart first electrodes to maintain a first voltage, one of
  - 6              said first electrodes disposed in either said first particle separating channel or said second
  - 7              particle separating channel.
- 1        2.     The device of claim 1 wherein at least two of said first electrodes are  
2              disposed in said first particle separating channel, one of said first electrodes proximate  
3              said second particle separating channel.
- 1        3.     The device of claim 1 wherein one of said first electrodes is disposed in  
2              said first particle separating channel and a second of said first electrodes is disposed in  
3              said second particle separating channel proximate said first particle separating channel.
- 1        4.     The device of claim 1 further including a third particle separating channel  
2              transverse to said first particle separating channel and in communication therewith, said  
3              third particle separating channel spaced apart from said second particle separating  
4              channel.
- 1        5.     The device of claim 4 further including an additional first electrode  
2              disposed either in said third particle separating channel proximate said first particle  
3              separating channel or in said first particle separating channel proximate said third particle  
4              separating channel.

1           6.       The device of claim 5 wherein said first electrodes are adapted to enable a  
2       voltage gradient to be applied to a solution when the solution is disposed in said first  
3       particle separating channel, said voltage gradient to cause charged particles within said  
4       solution to migrate in said first particle separating channel.

1           7.       The device of claim 1 further including a second electrode disposed in said  
2       second particle separating channel to maintain a second voltage, said second voltage to  
3       cause charged particles in a solution to migrate in said second particle separating channel.

1           8.       The device of claim 7 further including sieving media disposed in said  
2       second particle separating channel.

1           9.       The device of claim 1 further including at least one reservoir disposed  
2       either on an end of said first particle separating channel or on the end of said second  
3       particle separating channel distal to said first particle separating channel.

1           10.      The device of claim 1 further including a conductivity detector disposed in  
2       said second particle separating channel, said conductivity detector including two spaced  
3       apart third electrodes.

1           11.      A method comprising:  
2                  forming a first particle separating channel and a second particle separating  
3       channel, said second particle separating channel transverse to said first particle separating  
4       channel and in communication therewith; and  
5                  disposing at least two spaced apart first electrodes in said particle  
6       separating channels to maintain a first bias potential in said first particle separating  
7       channel, one of said first electrodes disposed in said first particle separating channel.

1           12.     The method of claim 11 wherein disposing at least two spaced apart first  
2 electrodes in said particle separating channels includes disposing another of said first  
3 electrodes in said second particle separating channel.

1           13.     The method of claim 11 further including disposing a second electrode in  
2 said second particle separating channel to maintain a second bias potential in said second  
3 particle separating channel.

1           14.     The method of claim 11 further including disposing sieving media in said  
2 second particle separating channel.

1           15.     The method of claim 11 further including coupling a reservoir to an end of  
2 either said first particle separating channel or said second particle separating channel.

1           16.     The method of claim 11 further including disposing a conductivity  
2 detector in said second particle separating channel.

1           17.     A system comprising:  
2                 a first particle separating channel and at least one second particle  
3 separating channel, said at least one second particle separating channel transverse to said  
4 first particle separating channel;  
5                 at least three spaced apart first electrodes to enable a voltage gradient to be  
6 applied to a solution when the solution is disposed in said first particle separating  
7 channel, at least one of said first electrodes disposed in either said first particle separating  
8 channel or said second particle separating channel; and  
9                 a pump to move said solution in said first particle separating channel  
10 against said voltage gradient.

1           18.     The system of claim 17 further including two spaced apart second  
2     electrodes disposed in said second particle separating channel to enable an electric field  
3     to be applied to a solution disposed in said second particle separating channel.

1           19.     The system of claim 17 further including at least one reservoir disposed at  
2     an end of either said first particle separating channel or said second particle separating  
3     channel such that said reservoir is in communication therewith.

1           20.     The system of claim 17 wherein said system is a micro-electro-mechanical  
2     system and said first particle separating channel and second particle separating channel  
3     are microfluidic channels.

1           21.     A method comprising:  
2                 applying an electric field gradient to a solution containing charged  
3     particles under conditions that will cause at least some of the charged particles to focus in  
4     a first channel formed in a device; and  
5                 without transfer, applying an electric field to the focused charged particles  
6     to cause the focused charged particles to migrate through a sieve disposed in at least one  
7     second channel in said device, said at least one second channel transverse to said first  
8     channel and in communication therewith.

1           22.     The method of claim 21 wherein applying the electric field gradient to the  
2     solution containing charged particles under conditions that will cause at least some of the  
3     charged particles to focus in the first channel includes causing at least some of the  
4     charged particles to focus at or near said at least one second channel.

1           23. The method of claim 22 wherein applying the electric field gradient to the  
2 solution containing charged particles under conditions that will cause at least some of the  
3 charged particles to focus in said first channel includes establishing a convective force in  
4 said solution.

1           24. The method of claim 22 wherein applying the electric field gradient to the  
2 solution containing charged particles under conditions that will cause at least some of the  
3 charged particles to focus in said first channel includes applying a first electric field  
4 gradient and a second electric field gradient to a solution containing charged particles  
5 under conditions that will cause negatively charged particles to focus in said first channel  
6 in said first electric field gradient and positively charged particles to focus in said first  
7 channel in said second electric field gradient.

1           25. The method of claim 24 wherein applying the first electric field gradient  
2 and the second electric field gradient to the solution containing charged particles under  
3 conditions that will cause negatively charged particles to focus in said first channel in  
4 said first electric field gradient and positively charged particles to focus in said first  
5 channel in said second electric field gradient includes causing at least some of the  
6 negatively charged particles to focus at or near at least one second channel and at least  
7 some of the positively charged particles to focus at or near at least another second  
8 channel.

1           26. The method of claim 21 further including causing said focused charged  
2 particles to be negatively charged.

1           27. The method of claim 21 wherein applying an electric field gradient  
2 includes applying a linear electric field gradient.

1           28.     The method of claim 21 further including detecting said charged particles  
2     in said at least one second channel.

1           29.     The method of claim 28 wherein detecting charged particles in said at least  
2     one second channel includes detecting a change in conductivity in a region of said at least  
3     one second channel.

1           30.     The method of claim 21 wherein applying the electric field gradient to the  
2     solution containing charged particles includes applying an electric field gradient to a  
3     solution containing proteins or portions thereof.